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knowledge specially prepared for school purposes, we can give a pupil a special dose of memory training, reasoning power, or fertility of imagination. All the training really possible or necessary will come incidentally in the acquisition of knowledge which is valuable for its informatory and not for its disciplinary effect. Pedagogical method *may* still be valuable, but it will be a method of presentation merely, not a method which puts practise and training before the acquisition of fact.

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RHYTHM AND THE SPECIOUS PRESENT[1]

A SATISFACTORY working hypothesis for the study of rhythm-perception has not yet been formulated, although several writers have come very close to the statement of the theory which seems to me adequate. That there is need of a new hypothesis is evident to any one who takes the trouble to go over the experimental literature dating from Bolton's paper.[2] The impression which one gets from this literature is that the psychologists are well aware that rhythm-perception presents a big problem, but are at sea as to the steps to be taken towards the solution thereof. An interesting light is thrown on this situation by the case of a German writer who is much quoted on the subject of rhythm-perception, and whose article of over a hundred pages was presumably preliminary to an account of extensive experiments of his own. The "Fortsetzung folgt" which concludes his second instalment remains an unkept promise, and there are certain things which indicate that he was unable to handle the experimental problems, that the undertaking was too much for him.

Introspective work has convinced me that the perception of a rhythmic grouping or series is conditioned by a periodic change in the specious present. When a series of stimulations (auditory, for example) runs off without any decided rhythm or grouping, the specious present maintains an approximately fixed length, or, at least, the variations in its length have no functional relation to the series of stimulations in question. Sensations appear serially, remain for a greater or less time in "present" consciousness, and fade out one by one. When the sensations begin to group rhythmically, either through the introduction of objective differences in intensity, duration, intervening period, or complexity, or through the factors which we for convenience designate as "subjective," the relation of the series to the specious present at once becomes definite.

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[1] Presented, in part, at the Chattanooga meeting of the Southern Society for Philosophy and Psychology, December 28, 1910.

[2] "Rhythm," *American Journal of Psychology*, 1894, Vol. VI., pp. 145–238.

If the sensations group by fours, forming what is called in the preferable terminology a "four-rhythm," the first member of each group, as it is roused, stands alone—alone, at least, in so far as the other members of the series are concerned. If the preceding sensations, belonging in other groups, are present at all, they are memory images: but it is highly probable that they are not present to consciousness even in that form. When the second sensation is aroused, the first is still present, not as a memory image, but as a sensation; present, that is, in the same way in which it was present when it first entered. The first, second, and third sensations are retained in the specious present until the fourth has arrived, and the four constituting the group are therefore actually sensed together. Immediately thereafter, the slate is cleared, as it were, for the next group. The specious present shrinks to such an extent that the sensations which a moment before were included in it are forced out.

There are numerous mechanical processes which might be used to illustrate this periodic elongation and contraction of the specious present. The action of a rosined violin bow on the string is such a process. However steadily the bow is drawn, the string is periodically drawn aside to the limit determined by the tension of the string and the friction, from which point it snaps back to begin the movement anew.

This specious present may be considered as being fixed at the "front" end, and as being stretched steadily backwards with the passing of time, until at the extreme point of stretch it contains that part of the time stream to which a group of the sensations corresponds; then it is released and snaps up to its original position, before the first member of the next group enters it.

The periodic change in the specious present is not essentially connected with variations in the degree of attention. Attention may be best at the beginning of the group, or at the end, or at some intermediate position, without affecting the essential features of the grouping.[3] The whole process may receive a high degree of attention, or a very low degree. But the specious present changes occur, or there is no rhythm. The attention-wave theory of rhythm-perception has no greater agreement with the facts than is to be found in its ascribing the grouping to some sort of periodicity in consciousness itself, rather than in the content!

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[3] The experiments of Arps and Klemm, *Psychologische Studien*, 1908, Vol. IV., pp. 505–529, in theory bear on this point, but are too crude to furnish any data.

The attention-wave theory is usually modified by a supplementary explanation in terms of synthetic activity of the mind.[4] For introspection, this is completely out of the question. The rhythm group is an immediate sensory fact, and depends on no higher synthesizing activity than does the fusion of two tonal elements.

We have no very reliable determinations of the series conditions which influence or determine the rhythmic groupings. Bolton thought that the most satisfactory duration for groups of twos, threes, fours, sixes, and eights was slightly over one second. An examination of his tables shows us that he has no evidence for this claim. He had no systematic procedure which would enable him to find what rates a subject would really prefer for a given group form, and, moreover, his results are obtained by averaging together a few determinations on several different subjects; a procedure which produces the most unreliable results. For example, the average rate of the three-groups for seven subjects was found to be 460 sigma, although only one of the subjects actually heard three-groups at the rates near that value.

For the influence of intensity-accents we have various agreements and disagreements of experimental results. It is certain that under proper conditions the accents may be heard at any position in the group; the group formed, that is, with the accented member occupying any position. What the "proper conditions" are, is a question; undoubtedly, the point at which the subject begins to hear the series is one of the influential factors, but the fact that subjective accents may be placed on practically any member of a group complicates the situation.

Several attempts have been made to show that there is a motor basis for rhythmic perception, but they can not be said to have had very important results. There is no doubt that periodic movement assists the formation of rhythmic groups in the content, but this fact has little bearing on the motor theories. The facts seem to be that all sorts of sensations lend themselves to serial grouping, and that if two series are practically coincident, they are grouped as one series. Hence, a series of auditory, visual, or tactual sensations which does not group easily alone, will group if combined with a strongly accented muscular series.

Stetson[5] has built up an ingenious but purely artificial motor theory of rhythm, based on the so-called "ballistic" movement:

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[4] See Bolton, *op. cit.*, p. 220.

[5] *Psychological Review,* 1905, Vol. XII., pp. 250–270, 293–350.

a movement due to the alternate contractions of antagonistic muscular systems, the contraction of the first system serving as the stimulus for the contraction of the second, which checks the movement and returns the member to the original position. No other type of muscular action, according to Stetson, can serve as a basis for rhythm. As a matter of fact, rhythms beaten by lifting the hand or foot, letting the member fall each time by gravity, are just as ''good'' subjectively as rhythms beaten by ''ballistic'' movements.

The motor theories of rhythm-perception rest on no other bases than the facts that motor expression of certain sorts is good rhythmic material, and that periodic stimulation usually produces muscular activity. No one has been able to show that the motor factor is indispensable, and the introspective evidence is clearly on the other side. With the utmost possible relaxation of the entire body, good rhythmic grouping of an auditory series can be obtained. The grouping is easier and more definite with objective accent, but can be obtained when there is no objective accent, and no discoverable motor rhythm. The subject must, of course, lie flat on his back in this experiment. With perfect relaxation the grouping, if it occurs, is devoid of subjective accent, a fact which inclines us to the belief that subjective accent is essentially a motor affair.

While there is no absolute need of accent in a rhythmic series, accent makes the establishment of the groups easier, *i. e.*, it assists in the maintaining of a regular periodicity in the specious present. Naturally, the strongest accent comes at the beginning of the group, because the first member of the group has to be carried farthest, but the accent may occur in other positions, as we well know.

It is probably true that for the majority of persons, and in the majority of cases, the accents are preferred on the first members of the groups. This we might infer from the accent system which has developed in music. Another fact, which is sufficiently well established, and which also we would all probably be willing to admit without much proof, is that a long interval or pause introduced periodically in a series of sounds tends to throw the sounds into groups limited by these pauses. We must remember, however, that there are subjects who present consistent exceptions to this rule, and that any subject is apt to depart from the rule if some factor suggests another form of grouping. It is not highly probable that a quantitative method of research on rhythm perception can be established on the general validity of any such rule.[6]

Accent has a definite effect on the time-relations in a rhythmic series, but this effect is really of no importance for the explanation of the grouping. The general fact is that a small time-interval limited by two dissimilar sensations seems longer than the same objective interval under conditions practically the same except for the limiting sensations being similar. This was brought out very forcibly by the results of Meumann's experiments on time-perception,[7] although Meumann himself did not notice it, and supposed that there was no uniform result to his experiments. He, however, was expecting to find a specific effect of a weak sound or a strong sound on the interval following it, or preceding it, as frequently occurs in rhythmic series, and did not notice the effect of intensity-difference. In a rhythmic series, the effect of the accent is to lengthen the interval preceding it, or following it, according to which is compared with the other intervals.[8] This effect comes out in groupings of three or more; with two-groups we can not get at it definitely, for obvious reasons.

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[6] See, however, Woodrow, ''A Quantitative Study of Rhythm,'' *Archives of Psychology,* 1909, No. 14, and ''The Rôle of Pitch in Rhythm,'' *Psychological Review,* 1911, Vol. XVIII., pp. 54–77.

The general effect of stimulus difference on the estimation of small time-intervals has been brought out in a number of investigations,[9] but it has no bearing on the rhythm problems.

When the groups are small and the rate rapid, the contraction of the specious present does not occur at the end of every group, but at the end of every second, third, or even every fourth group. In this case there is a complex grouping; the unit groups are perceived as elements in a larger group, and accent is practically indispensable, for it is only by accent of some sort that the small groups can be set off from one another in the large group. Theoretically, a differential spacing should accomplish the same result, as, for example, when three-groups are given with relatively short intervals between the members of the group, and relatively long intervals between the groups. But practically, subjective accent enters in every such case, even when there is no objective accent.

With simple grouping, *i. e.*, where the periodic change of the specious present corresponds to the single groups, a longer interval between groups is more favorable to the contraction phase of the process; and hence the occurrence of a longer interval every second, third, or fourth interval may determine the grouping in twos, threes, or fours, if other conditions are not too strongly in favor of some other grouping. Here again we find there is no absolute need of this relation; the slate may be cleared in the shortest intervals of the series, if other conditions favor this sort of grouping.

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[7] "Beiträge zur Psychologie des Zeitsinnes," II., *Philosophische Studien*, 1894, Vol. IX., pp. 289–297.

[8] See Woodrow, *Archives of Psychology*, No. 14, pp. 8–9.

[9] See Schumann, *Zeitschrift für Psychologie*, 1893, Vol. IV., p. 67; Dunlap, *Harvard Psychological Studies*, 1903, Vol. I., p. 116; Miner, *Psychological Review Monographs*, 1903, Vol. V., pp. 68, 78–79.

The early members of a group are not present to consciousness as memory images when the last member occurs. It is experimentally easy to hold a memory image of a sound in consciousness until the sound is given again—if the sequence is fairly slow—but at the moment when the new sound occurs, the memory of the old disappears. It is practically impossible to have a sound-sensation and also simultaneously the memory-image of a sound of approximately the same quality. Moreover, the memory image held in the way described requires an appreciable time to arise, and is very decidedly not the sort of thing which is held in the rhythm series.

The physiological schematization of a sensation "present" to consciousness after its physiological process has practically disappeared is not easy. Nor can we simplify matters by assuming continuation of the brain processes. In that case the discreteness of the sensations would be lost. We must in any event construct our brain physiology to fit the psychological facts, and not *vice versa.* The specious present is a function of consciousness and not of the brain states. In the actual present moment—the mathematical present—the particular content of consciousness and the particular brain state *may* synchronize perfectly; we have, so far as I know, no evidence either for or against this assumption. But in the mathematical past, while the content may be speciously still "present," the brain state, which was never content of consciousness, is simply "past."

The function of the specious present in other matters than grouping of content factors may be very important. In comparison-judgments, for example, it is undoubtedly a matter of consequence if the compared contents are both held in the same present, or occupy different presents. The historic work on time perception, although it has not given us any very reliable data, suggests the idea that the varying relations of time-interval to specious present had a large share in determining the judgments.

The emotional effect of various degrees of extension or shortening of the normal present—if there is a normal present—offer a very attractive field for investigation. It does seem that a musical unit requiring a rather long or a rather short specious present for its apprehension produces a specific effect, or rather that in the emotional effects of compositions based on such units there are factors which depend on this feature. The difference between the music having a perceptual unit and the music having no such unit—no unit which may be apprehended in a specious present—is striking, and the average man requires considerable training in the hearing of music of the latter kind before he will admit that it is music at all.

Among those who came near the statement of the above theory of rhythmic perception, I may mention the following. McDougal says: "The whole group of elements constituting the rhythmic unit is present to consciousness as a single experience; the first of its elements has never fallen out of consciousness before the final member appears, and the awareness of intensive differences and temporal segregation is as immediate a fact of sensory apprehension as is the perception of the musical qualities of the sounds themselves."[10] Yet in spite of this statement, McDougal went on to construct a motor theory of rhythm which directly contradicted it. Bolton says: "Does it not, then, seem reasonable, that during each wave or pulse of attention only one undivided state of consciousness can arise?" "The object of the state may be very complex, but it stands as a unit in consciousness."[11] Then he reverts to his attempt to interpret Wundt, and explains rhythm as a product of the "unifying activity of the mind," which attempts to "conceive a series of sounds in a simpler form."[12]

It is worthy of remark that Wundt, in the discussion of the span of consciousness with rhythmic impressions,[13] distinctly avoids bringing into the consideration the periodicity of consciousness or attention of which he makes much in other places. He does schematize the impressions as present simultaneously, but apparently figures them as fading out of consciousness in the same order as that in which they enter, not attempting to establish any connection between the rhythmic grouping and the simultaneous presentation. Again, he says, "Diese Entwicklung des rhythmischen Bewusstseins durchaus zusammenfällt mit der Entwicklung des Zeitbewusstseins selbst, so das unter allen Umständen der im Bewusstsein unmittelbar noch als ein einheitliches Ganzes aufgefasste Takt auch den Umfang einer noch unmittelbar, also simultan im Bewusstsein gegebenen Zeitvorstellung bezeichnet;"[14] avoiding, it seems, the simplest explanation of rhythm, in order to correlate it with time.

The chief recommendation which can be found for any theory in psychology is in its being a fertile source of experimental inquiries. That the theory I am advancing is very fertile will be demonstrated before long.

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[10] "The Structure of Simple Rhythm Forms," *Harvard Psychological Studies*, Vol. I., p. 322. Compare with the first sentence in the first paragraph on page 219.

[11] *Op. cit.*, p. 155.

[12] *Op. cit.*, p. 220.

[13] "Physiologische Psychologie," fifth edition, Vol. III., pp. 353–356.

[14] *Op. cit.*, Vol. III., p. 33.